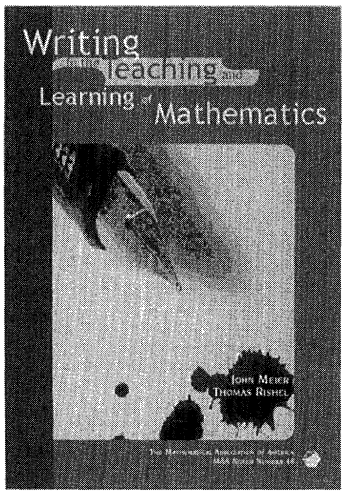

Writing in the Teaching and Learning of Mathematics

JOHN MEIER AND THOMAS RISHEL

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Writing in the Teaching and Learning of Mathematics discusses both how to create effective writing assignments for mathematics classes and why instructors ought to consider using such assignments. The book is more than just a user's manual for what some have termed "writing to learn mathematics;" it is an argument for engaging students in a dialogue about the mathematics they are trying to learn.

The first section, "First Steps," contains chapters addressing the nuts and bolts of how to design and evaluate writing assignments. The second section, "Listening to Others," introduces ideas such as audience, narrative, prewriting and process writing, which our colleagues in writing departments have found useful. Specific examples illustrate how these are important for writing in mathematics classes. After the third section, "Major Projects," the text concludes with "Narrating Mathematics," a section making explicit what is implicit in the rest of the text: writing, speaking and thinking are all intertwined. By asking good questions and critiquing students' manuscripts in an open, yet rigorous manner, instructors can get students at any level of ability and background to a deeper awareness of the beauty and power of mathematics.

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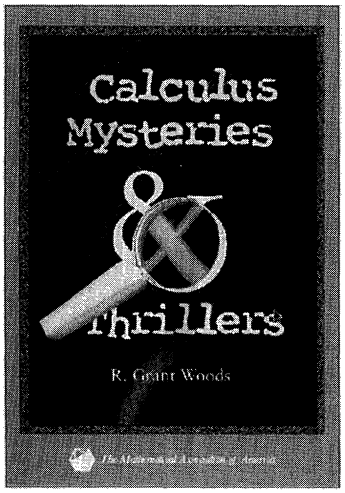

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Calculus projects you can give to your students . . .

This book consists of eleven mathematics projects based on introductory single-variable calculus, together with some guidance on how to make use of them. Each project is presented as an amusing short story. In many of them a group of undergraduate mathematics students, formed into a consulting company called *Math Iz Us*, is hired to solve mathematical problems brought to them by clients. The problems solved include: helping to prosecute an accused pool shark, defending a driver accused of speeding, assisting a hockey coach in making his star forward a more effective goal scorer, and advising a pirate captain on how to divide a gold-plated goose-egg fairly among his crew.

In each problem, the problem solvers are required to present to their client a detailed written report of their findings. Thus, students must produce and analyze accurate mathematical models of complex, verbally presented "real life" situations, and write a clear technical account of their solution.

Instructors who are looking for problems that are novel, interesting, and several levels more complex than the typical text book "word problem" will find them in this book. It will be of particular value to instructors who wish to combine training in applications of calculus with training in technical writing. The complexity of the problems makes them suitable for use as group projects.

The calculus concepts on which the problems are based include: tangent and normal lines, optimization by use of critical points, inverse trig functions, volumes of solids, surface area integrals, and modeling economic concepts using definite integrals. Although a few ideas from physics and economics are used in the problems, no prior knowledge of these fields is required.

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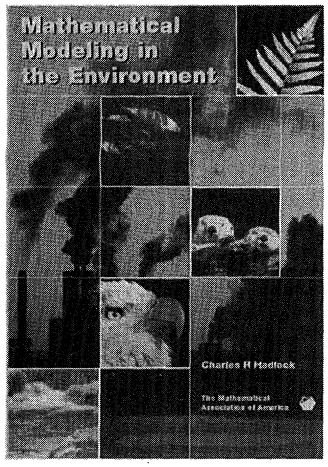

THE MATHEMATICAL ASSOCIATION OF AMERICA

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This book has a dual objective: first, to introduce the reader to some of the most important and widespread environmental issues of the day; and second, to illustrate the vital role played by mathematical models in investigating these issues. The environmental issues addressed include: ground-water contamination, air pollution, and hazardous material emergencies. These issues are presented in their full real-world context, not as scientific or mathematical abstractions; and for background, readers are invited to investigate their status in their own communities.

The first part of the book leads the reader through relatively elementary modeling of these phenomena, including simple algebraic equations for ground water, slightly more complex algebraic equations (preferably implemented on a spreadsheet or other computerized framework) for air pollution, and a fully computerized modeling package for hazardous materials incident analysis. The interplay between physical intuition and mathematical analysis is emphasized.

For more advanced readers, the second part of the book returns to the same three subjects but with a higher level of mathematical sophistication (adjustable to the preparation of the reader by selection of subsections.) Many important classical mathematical themes are developed through this context, examples coming from single and multivariable calculus, differential equations, numerical analysis, linear algebra and probability. The material is presented in such a way as to minimize the required background and to encourage the subsequent study of some of these fields.

An elementary course for a general audience could be based entirely on Part I, and a higher level mathematics, science, or engineering course could move quickly to Part 2.

A PC compatible diskette packaged with the text contains a spreadsheet program that facilitates the numerical experimentation with the Gaussian plume equation introduced in Chapter 3, as well as public domain DOS program (ARCHIE) for evaluating the consequences from various hazardous materials scenarios (e.g., the physical extent of flammable and toxic vapor clouds). Text is not tied to the use of this software, but it is included as an aid to meet the pedagogical objectives of the text.

Catalog Code: ENV/SA
312 pp., Paperbound, 1998, ISBN 0-88385-709-X
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Charles Hadlock

Contains the complete solutions and further discussion of nearly every exercise presented in the textbook. This includes both the mathematical/computational exercises as well as the research questions and investigations. Readers will benefit greatly from perusing solutions to the problems whether they have worked them out themselves or not. Students using this volume will still need to work out solutions of research questions using their own sources and adapting them to their own geographic locations, or using their own computational schemes, so this volume could well be useful for students in many course contexts. Enrichment material is included on the topics of some of the exercises. Advice for teachers who lack previous environmental experience, but who want to teach this material is also provided and makes it practical for such persons to offer a course based on these volumes.

Catalog Code: EVS/SA
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Euler

The Master of Us All

William Dunham

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Without question, Leonhard Euler (1707-1783) ranks among history's greatest mathematicians. Across six decades of unmatched productivity, and despite a visual impairment that grew ever worse, he charted the course of mathematics throughout the eighteenth century and beyond. His reputation is captured in Laplace's famous admonition, "Read Euler, read Euler. He is the master of us all."

Written for the mathematically literate reader, this book provides a glimpse of Euler in action. Following an introductory biographical sketch are chapters describing his contributions to eight different topics—number theory, logarithms, infinite series, analytic number theory, complex variables, algebra, geometry, and combinatorics. Each chapter begins with a prologue to establish the historical context and then proceeds to a detailed consideration of one or more Eulerian theorems on the subject at hand. Each chapter concludes with an epilogue surveying subsequent developments or addressing related questions that remain unanswered to this day. At the end of the book is a brief outline of Euler's collected works, the monumental *Opera Omnia*, whose publication has consumed virtually all of the twentieth century.

In all, the book contains three dozen proofs from this remarkable individual. Yet this is merely the tip of the scholarly iceberg, for Euler produced over 30,000 pages of pure and applied mathematics during his lifetime. *Euler: The Master of Us All* samples the work of a mathematician whose influence, industry, and ingenuity are of the very highest order.

Catalog Code: DOL-22/JR
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Leads students quickly to the key ideas of combinatorics in a logical and proactive way . . .

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The format is unique in that it combines features of a traditional textbook with those of a problem book. It is organized in eight sections, the first four of which cover the basic combinatorial entities of strings, combinations, distributions and partitions. The last four cover the special counting methods of inclusion and exclusion, recurrence relations, generating functions, and the method of Pólya and Redfield that can be characterized as "counting modulo symmetry." The subject matter is presented through a series of approximately 250 problems with connecting text where appropriate, and is supplemented by approximately 220 additional problems for homework assignments. Many applications to probability are included throughout the book.

While intended primarily for use as a text for a college-level course taken by mathematics, computer science and engineering students, the book is suitable as well for a general education course at a good liberal arts college, or for self-study.

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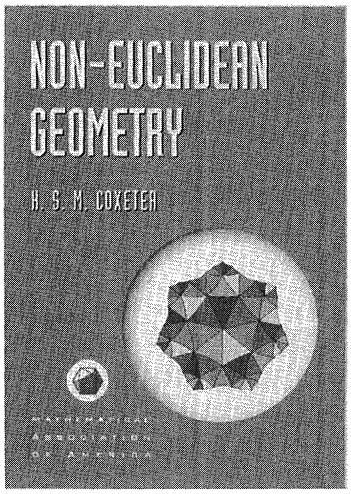

Non-Euclidean Geometry

Sixth Edition

H. S. M. COXETER

Series: Spectrum

H. S. M. Coxeter's classic book on non-Euclidean geometry was first published in 1942, and enjoyed eight reprintings before it went out of print in 1968. The MAA is delighted to be the publisher of the sixth edition of this wonderful book, updated with a new section 15.9 on the author's useful concept of inversive distance.

Throughout most of this book, non-Euclidean geometries in spaces of two or three dimensions are treated as specializations of real projective geometry in terms of a simple set of axioms concerning points, lines, planes, incidence, order and continuity, with no mention of the measurement of distances or angles. This synthetic development is followed by the introduction of homogeneous coordinates, beginning with Von Staudt's idea of regarding points as entities that can be added or multiplied. Transformations that preserve incidence are called collineations. They lead in a natural way to elliptic isometries or "congruent transformations". Following a recommendation by Bertrand Russell, continuity is described in terms of order. Elliptic and hyperbolic geometries are derived from real projective geometry by specializing an elliptic or hyperbolic polarity which transforms points into lines (in two dimensions) or planes (in three dimensions) and vice versa.

An unusual feature of the book is its use of the general linear transformation of coordinates to derive the formulas of elliptic and hyperbolic trigonometry. The area of a triangle is related to the sum of its angles by means of an ingenious idea of Gauss. This treatment can be enjoyed by anyone who is familiar with algebra up to the elements of group theory.

Catalog Code: NEC/JR
320 pp., Paperbound, 1988
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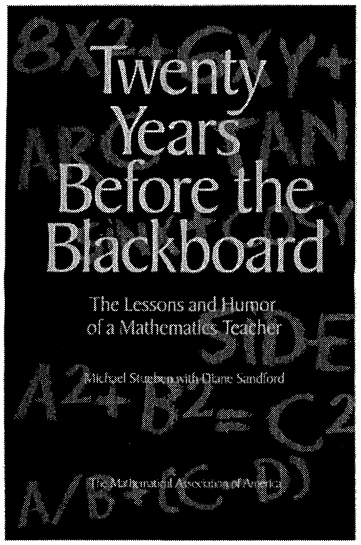

Twenty Years Before the Blackboard

The Lessons and Humor of a Mathematics Teacher

Michael Stueben with Diane Sandford

Series: Spectrum

A perfect gift for the new teacher. . . or for anyone interested in the teaching of mathematics.

This book is the legacy of twenty years of mathematics teaching. During this time, the author searched for motivation techniques, mnemonics, insightful proofs, and serious applications of humor to aid his teaching. The result is this book: part philosophy, part humor, and part biography. Readers will be amused and enlightened on every page.

Mr. Stueben shows how he has used humor and wordplay to motivate his students. The book is filled with wonderful problems and proofs, as well as the author's insights about how to approach teaching problem solving to high school students. Sections of the book also treat the use of calculators and computers in the classroom. A section on mnemonics shows how teachers can use memory aids to help their students learn and retain material.

All in all, *Twenty Years Before the Blackboard* provides a goldmine of ideas for the classroom teacher. Although Mr. Stueben taught at the high school level, his book is an excellent "methods" book for mathematics teachers at all levels.

Read what Martin Gardner has to say about this fascinating book:

It's been decades since I read so entertaining a book about mathematics. The book is a treasure-trove of mathematical jokes, rhymes, anecdotes, word play, mnemonics, and beautiful proofs. For teachers there is an abundance of wise advice based on the author's twenty years in high school teaching. Mathematicians at all levels, from amateurs to college professors will not only chuckle over its gems, but learn much they did not know before. —Martin Gardner

Catalog Code: TYB/JR98
174 pp., Paperbound, 1998, ISBN 0-88385-525-9
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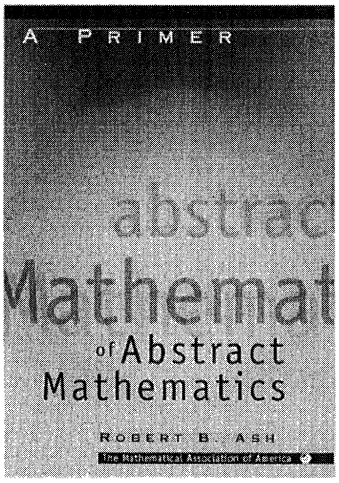

THE MATHEMATICAL ASSOCIATION OF AMERICA

A Primer of Abstract Mathematics

Robert Ash

Series: Classroom Resource Materials

A Primer of Abstract Mathematics prepares the reader to cope with abstract mathematics, specifically abstract algebra. It can serve as a text for prospective mathematics majors, as well as for those students taking or preparing to take a first course in abstract algebra, or those in applied fields who need experience in dealing with abstract mathematical ideas.

Learning any area of abstract mathematics involves writing formal proofs, but it is equally important to think intuitively about the subject and to express ideas clearly and cogently. The author aids intuition by keeping proofs short and as informal as possible, using concrete examples which illustrate all the features of the general case, and by giving heuristic arguments when a formal development would take too long. The text can serve as a model on how to write mathematics for an audience with limited experience in formalism and abstraction.

Ash introduces several expository innovations in *A Primer of Abstract Mathematics*. He presents an entirely informal development of set theory that gives students the basic results that they will need in algebra. The chapter which presents the theory of linear operators introduces the Jordan Canonical Form right at the beginning, with a proof of existence at the end of the chapter.

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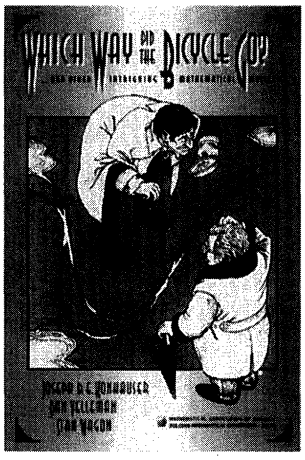

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and Other Intriguing Mathematical Mysteries

Joseph D. E. Konhauser, Dan Velleman, and Stan Wagon

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This book contains the best problems selected from over 25 years of the Problem of the Week at Macalester College. Readers will find here a collection of intriguing and thought provoking problems that will give students (high school or beyond), teachers, and university professors a chance to experience the pleasure of wrestling with some beautiful problems of elementary mathematics.

Compare your sleuthing talents with those of Sherlock Holmes, who made a bad mistake regarding the first problem in the collection: Determine the direction of travel of a bicycle that has left its tracks in a patch of mud. The collection contains a variety of other unusual and interesting problems in geometry, algebra, combinatorics and number theory. For example, if a pizza is sliced into eight 45-degree wedges meeting at a point other than the center of the pizza, and two people eat alternate wedges, will they get equal amounts of pizza? Or: What is the rightmost nonzero digit of the product $1 \cdot 2 \cdot 3 \cdots 1000000$? Or: Is a manufacturer's claim that a certain unusual combination lock allows thousands of combinations justified?

Complete solutions to the 191 problems are included along with problem variations and topics for investigation. This collection will be especially valuable to teachers who are looking for stimulating ways to engage their students with the beauty and intrigue that can often be found in elementary mathematics.

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